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ABSTRACT

This paper examines the discourses that dominate thinking about assessment in mathematics education; that is, to analyze the sets of constructs, assumptions, and values that underpin research, curriculum development, and teacher education with regard to assessment. Dominant discourses within mathematics education are analyzed and the social functions that assessment fulfills within the classroom and in the broader society are discussed. (Contains 34 references.) (KHR)

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Discourses of Assessment--
Discourses of Mathematics

by
Candia Morgan

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DISCOURSES OF ASSESSMENT – DISCOURSES OF MATHEMATICS

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MAINSTREAM DISCOURSES OF ASSESSMENT IN MATHEMATICS EDUCATION

Current debates about assessment in mathematics education have focused on the idea of 'authenticity' of assessment tasks and on the influence that various forms of assessment may have – for good or for bad – on the mathematical experiences and learning of students (see, e.g. Leder, 1992; Niss, 1993; Romberg, 1995). The big question has been *how* to assess in order to fulfil various functions rather than *why* to assess at all. For most of those involved in education and educational research, assessment appears to be an essential and natural part of educational processes. Without some form of assessment, how could we teach and how could we know about learning? Although in some circumstances particular forms of assessment may be seen to be inappropriate or even harmful, there is a strong consensus that, in principle, assessment is necessary and even beneficial to teaching and learning. We have, however, seen changes over time and differences between countries and between groups of educators, researchers, and policy makers in the forms of assessment that are valued and the types of knowledge sought through assessment processes.

In this paper, I intend to examine the discourses that dominate thinking about assessment in mathematics education – that is, to analyse the sets of constructs, assumptions and values that underpin research, curriculum development and teacher education in relation to assessment. Such an analysis necessarily lays these constructs, assumptions and values open to question by identifying their contingent, historically and socially situated nature. It also identifies tensions between competing discourses associated with current practices. The dominant discourses within mathematics education obscure the social functions that assessment fulfils within the classroom and in the broader society. I shall argue that, if we are concerned with social issues within mathematics education, we must challenge these dominant discourses and the practices associated with them.

Psychological discourses

Until fairly recently, research in most aspects of mathematics education has been heavily dominated by constructs and methods located within explicitly psychological discourses.

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This has been particularly true of assessment. The main aims of researchers in this area have been the development, use and validation of improved assessment instruments to characterise the attributes of individual students or to construct models of the general characteristics of knowledge and understanding in a given area of mathematical activity. The types of attributes and aspects of mathematics involved include both 'traditional' areas of study, such as 'geometry', and areas associated with current curriculum reform movements, such as 'problem solving'. Some of the studies reported appear to be 'pure' research while others are explicit in their intention to provide tools for teachers to use or to influence teachers' practice. Some have adopted a broadly Piagetian framework, assessing the stage that children have reached; others, more recently, work within a Vygotskian framework, developing the idea of dynamic assessment. While there may be substantial differences in the aims, content and theoretical framing of such studies, they all share two fundamental assumptions. Firstly, it is assumed that individuals possess attributes (such as knowledge, understanding, skill, ability, etc.) that are discoverable and measurable. Secondly, the primary purpose of assessment is seen to be to discover and measure these attributes.

It is not only research that has been dominated by this psychological discourse. It has also had a strong influence on policy and practice in schools. I shall illustrate this influence by looking at some extracts from documents issued recently by the UK government Teacher Training Agency, describing what trainee teachers in England and Wales must learn and be able to do before being accredited as qualified teachers. The first extract shows clearly that assessment is presented as a straightforward means of determining the characteristics of students' understanding. Teachers are expected to know:

> how to use formative, diagnostic and summative methods of assessing pupils' progress in mathematics, including:
>
> (i) identifying from pupils' oral and written work and from observation of their practical mathematical skills, the basis of their understanding of mathematics; ...
>
> (iii) preparing oral and written questions and setting up activities and tests which check for:
>
> - misconceptions and errors in mathematical knowledge and understanding, to identify specific mathematical issues which need further attention;
> - understanding of mathematical ideas and the connections between different mathematical ideas (DfEE, 1998a)

Teachers are to be experts, not only in using instruments devised by others, but also in preparing their own instruments to assess pupils' understanding. The actions the teachers are to perform – *identifying* and *checking* – suggest a world in which observation provides absolute knowledge of the character of the object observed. Interpretation of the information appears not to be an issue.

There have, of course, been changes over time in the types of mathematical knowledge, skills or understanding to be assessed, the methods used to do this and the theories of learning underpinning the assessment (see Table 1). As Gipps (1996) points out, the original development of psychometric testing was based on a notion of uni-dimensional intelligence, and what we now perceive as 'traditional' multiple choice tests and examinations of knowledge and skills were based on behaviourist principles. The mathematics assessed by such tests tended to be restricted to knowledge of facts, skills and standard procedures. More recent developments, with their emphasis on 'authentic' assessment (e.g. Romberg, 1995) have been more or less explicitly grounded on constructivist theories of learning and views of the nature of mathematical knowledge. Even in the document we have just seen (produced by an agency not well known for its progressive views), the teachers' assessment will not only find errors in the mathematical *texts* produced by the pupils – it will find errors in their *understanding* and, going even more deeply into the cognition of individual pupils, the *basis* of their understanding. Mathematics and the object of mathematical education, therefore, are not just composed of facts and skills but also involve individual conceptions and connected ideas.

The assumptions of the psychological discourses of assessment are all rooted in a strongly positivist tradition. That is, they are predicated on the belief that there is an underlying truth to be assessed/discovered and that it is theoretically possible to get as close as you might wish to this underlying truth. This positivist tradition is perhaps even stronger in mathematics than in other subject areas: there are only right or wrong answers; you either know the right answer or you don't. Uncertainty and non-excluded middles in mathematical contexts are deeply uncomfortable for many people, even for those who might find them less surprising in other disciplines. Interestingly, currently fashionable constructivist theories of learning challenge both the idea that there is some absolute 'truth' about students' understanding of mathematics and the idea that any instrument could observe and measure such a state. Yet such epistemological concerns have had little impact on thinking about assessment (Galbraith, 1993). The authentic tasks associated

with constructivist-inspired curriculum reform still seek for 'authentic' knowledge of student understanding.

Table 1: Models of assessment[1]

assessment instruments	**theories of knowledge and learning**	**assessment discovers ...**	**nature of mathematical knowledge**
psychometric testing	uni-dimensional intelligence	absolute measure of intelligence	irrelevant (because dependent on general intelligence)
traditional tests and examinations	behaviourism	skills attained	facts, skills and standard procedures
'authentic' tasks	constructivism	nature of personal understanding	personal and contextualised

The traditional psychological discourse of assessment was concerned only with the cognitive attributes and development of students. In considering the ways in which assessment might support teaching and learning, knowledge of these attributes was the only factor considered. More recent developments take a broader view of the student and of ways in which assessment may affect learning. Particularly influential, both in the United States and internationally, has been the reform agenda of the National Council of Teachers of Mathematics, based on a more flexible view of mathematics and mathematical learning, encompassing student creativity, processes and attitudes as well as traditional content (NCTM, 1989). Accompanying its recommendations about mathematics and about classroom teaching and learning processes, the reform has also addressed assessment issues. In doing so, it has broadened the role of assessment and enhanced its importance within mathematics education. No longer is assessment just a neutral means of measuring students' attributes – its neutrality guaranteed by statistical standardisation and elimination of bias. It is now explicitly seen as contributing to teaching and learning in complex ways and, in doing so, promoting the values embodied in the intended curriculum.

> In order to develop mathematical power in *all* students, assessment needs to support the continued mathematical learning of *each* student. This is the central goal of assessment in school mathematics. In our view, assessment occurs at the intersection of important mathematics content, teaching practices, and student learning. Assessment that embodies the vision of the six standards presented here will be a dynamic process that

> informs teachers, students, and others and supports each student's continuing growth in mathematical power. (NCTM, 1995, p. 6, original italics)

The idea that it should embody a vision brings assessment explicitly into the realm of values, while the notion of mathematical power is one that is closely identified with the accompanying curriculum reform. The formative aspects of assessment are to the fore here – it is envisaged as dynamic and as supporting learning rather than simply as providing a measure.

The officially beneficial nature of assessment is also apparent in the UK reforms. Teachers are to use it to improve their teaching and to intervene 'purposefully' in pupils' learning:

> Those to be awarded Qualified Teacher Status must, when assessed, demonstrate that they: ... assess and record each pupil's progress systematically, including through focused observation, questioning, testing and marking, and use records to: ...
>
> - monitor strengths and weaknesses and use the information gained as a basis for purposeful intervention in pupils' learning;
> - inform planning (DfEE, 1998b)

By characterising students' understanding, teachers are to be able to adapt their teaching to make it more effective. (Of course, any underlying theory of how learning might progress, given a particular state of understanding, is absent.)

But gaining information about students is not the only function of assessment. Information about cognitive attributes may even take a back seat, as in this extract from a recent book about assessment of 'significant achievement' in mathematics addressed to primary school teachers:

> The purpose of the assessment process is to make explicit children's achievements, celebrate their achievements with them, then help them to move forward to the next goal. Without children's involvement in the assessment process, assessment becomes a judgmental activity, resulting in a one-way view of a child's achievement. Information gathered in this way has minimal use. When shared with the child, assessment information is more likely to result in a raising of standards, because the child is more focused, motivated and aware of his or her own capabilities and potential. Good assessment practice enables children to be able to fulfil their learning potential and raises self esteem and self-confidence. (Clarke & Atkinson, 1996, p. 9)

The underlying theory of learning here emphasises the role of affective factors such as motivation. The outcomes of assessment thus contribute to teachers' planning of interventions not only to influence students' cognition directly but also to influence their

"self esteem and self-confidence". As well as participating in the individualised psychological discourse of enabling children to "fulfil their learning potential", the author here also makes use of the idea of using assessment for "raising standards" – a component of the curriculum reform discourses that I shall turn to next.

Curriculum reform discourses

In recent years, educators and governments around the world have been engaging in debates about the mathematics curriculum and have instigated major curriculum reforms. These curriculum reforms have, in many cases, been associated with and accompanied by reform of assessment. We have seen increasing interest in the role of assessment in the context of curriculum reform among researchers as well as among curriculum developers (the two groups are, of course, not distinct) and this has been marked by a move away from a strictly psychological discourse. Within what I am calling curriculum reform discourses of assessment there are two strands, focused on the practical problem of curriculum implementation and on "raising standards" – on the regulation of the system.

Implementation

Assessment is clearly used for more than just to inform teachers' planning and teaching. It is widely recognised that assessment emphases and structures have a strong influence on the curriculum experienced by teachers and students. This is especially the case where tests and assessment tasks and norms are imposed and designed by an authority at a level higher than the individual teacher (whether at school level, local, state, national, or even international level). This has led to calls for assessment to be deliberately designed to lead curriculum reforms, modelling the values and principles of the intended curriculum in "beautiful" (Burkhardt, 1988) or "balanced" (Ridgway & Schoenfeld, 1994) assessment schemes. From this perspective, assessment methods are not only expected to match the values of the curriculum reform but are also to be used to coerce teachers into teaching in ways consistent with the curriculum objectives. Although *coerce* is a word that is not acceptable within this discourse (teachers are to be *encouraged* and *supported*), I am using it to highlight the relationship between teachers and those with the power to instigate curriculum and assessment reform. Such coercion may be successful in changing teachers' practices to enable more students to match the expectations of the assessment tasks. This is not necessarily equally effective in making teaching practices match curriculum aims, particularly where assessment values such as reliability and objectivity are in tension with reform curriculum values such as creativity and collaborative working.

(See, for example, Morgan, 1997 on the distorting effects of institutionalisation by assessment on the ideals of investigative mathematics.)

Even where the idea that assessment drives the curriculum is not so explicit, contestation over the nature of the curriculum often manifests itself in debates about the nature of assessment tasks and systems. Some examples from the UK context:

1. Contrast the unquestioned authority of a question appearing in a national examination paper in 1985 (in the context of the Falklands/Malvinas War between Britain and Argentina):

   > A pilot flying an aeroplane in a straight line at a constant speed of 196m/s and at a constant height of 2000m, drops a bomb on a stationary ship in the vertical plane through the line of flight of the aeroplane. Assuming that the bomb falls freely under gravity, calculate, (a) the time which elapses after release before the bomb hits the ship, (b) the horizontal distance between the aeroplane and the ship at the time of release of the bomb, and (c) the speed of the bomb just before it hits the ship.

   with the fuss made by a government minister about another examination question, this time labelled "unacceptable", comparing military spending with the resources needed to address human needs:

   > The money required to provide adequate food, water, health and housing for everyone in the world has been estimated at £11,500 million. How many weeks of NATO plus Warsaw Pact military spending would be enough to pay for this?[2]

   Should the mathematics curriculum be neutral (i.e. reflect the dominant ideology of the current rulers) or may it address issues of values?

2. Consider the attack by the Secretary of State for Education on the "elaborate nonsense" of assessment tasks devised for the first national assessment of 14-year-olds in 1991. The contract for developing these tests was subsequently cancelled (Broadfoot & Gipps, 1996). Should the mathematics curriculum engage students in extended and open problem solving or should it concentrate on disseminating facts and procedures?

The power of assessment to influence the curriculum is a double-edged sword. It is necessary to ask who is controlling the reform and in whose interests they act. In recent years in the United Kingdom, we have seen a change in the relationships between teachers, curriculum reforms and assessment practices. In the 1970s and early 1980s, reformers who wished to see greater diversity in the curriculum and opportunities for wider groups

of students to participate in mathematics made use of innovative assessment methods to encourage the teaching of problem solving and the use of mathematical investigation in the classroom (see, for example, Love, 1981). Many of those actively involved in setting the agenda for such reforms were themselves classroom teachers. In 1988, with the introduction of a new national system of examination for England and Wales, some of these practices were officially endorsed and, eventually, made compulsory. This use of assessment to instigate universal reform actually acted to distort and impoverish the types of rich mathematical activity it was apparently intended to encourage[3] (Morgan, 1997). Since the late 1980s, assessment has increasingly been used as a tool in the move towards centralised control of the curriculum. Teachers have lost most of their opportunities to innovate and to have their innovations validated through the official assessment system. Both the content and the method of teaching have been deliberately engineered through the introduction and shaping of national tests for political as much as educational purposes. As Galbraith argues, the now generally accepted idea that external assessment requirements should be used to influence the curriculum is "ultimately disempowering to teachers in impeding the growth of full professional responsibility, and to students in making their choices and interests irrelevant." (Galbraith, 1993, p.82).

Standards

A second discourse of curriculum reform that is currently powerful within the United Kingdom and elsewhere is the discourse of *standards* (using a meaning for standards rather different from that of the NCTM) and target setting. Here, rather than directing the reform effort at changing the processes of teaching, it is directed at the outcomes. The kinds of educational experiences offered to students are irrelevant except in so far as they lead to high scores when the students are assessed. Rather than focusing on the learning needs of individuals, this discourse focuses on the outcomes of education, usually at a higher level in the education system. Thus targets are set for individual pupils based not only on assessment of their personal cognitive state but on 'benchmarks' for attainment set at a national level. The same document that demands that teachers should use information gained through assessment to "intervene purposefully" in students' learning also expects them to

> know how to use national, local, comparative and school data ... to set clear targets for pupils' achievement . (DfEE, 1998b)

Targets are also set for schools and teachers in terms of the examination results their pupils should achieve. A natural consequence of this is that schools and teachers focus their attention and efforts on meeting the targets by whatever means are available. For example, secondary schools are compared by reference to the proportion of their students gaining grades A-C in national examinations. There is plenty of evidence to suggest that some schools and teachers pay extra attention (including better resourcing and extra teaching time) to those students on the borderline for achieving these grades rather than distributing resources according to the learning needs of the individual students concerned. As Gillborn and Youdell (1999) point out, those excluded from this special attention because they are considered unlikely to reach the crucial 'C' threshold include "a disproportionately high number of working-class children; pupils with special educational needs; and African Caribbean young people."

The discourse of standards is more or less explicit about its regulative function. International competitiveness and the needs of industry are appealed to as justification for raising standards – though the link between achievement on international comparative tests and the economic well-being of the country is less than proven. (And the correlation between shrinking employment opportunities for young people and government policies for the expansion of further and higher education tends not to be mentioned.) At the same time, however, the term *standards* is used as a transcendental signifier, an unquestionably good thing that does not need definition. In debates in the UK about the curriculum for 16-19 year-olds those who wish to conserve the traditional academic elitist structure and those who wish to introduce a broader reformed structure giving equal value to academic and vocational studies both appeal to the goal of maintaining or raising standards.

Summary of mainstream discourse

The main features of the various mainstream discourses of assessment that I have discussed above are summarised in Table 2. It would be very easy at this point to make value judgements about the aims and values of each of these discourses and to say "this way of thinking about assessment is good" and "this way is bad". In particular, for many of us who are concerned with the ways in which individuals and groups of individuals are disadvantaged and oppressed by educational practices and systems, the psychological discourse with its concern for individual needs and the pedagogic role that it constructs for teachers seems most congenial. Moreover, the use of assessment systems to coerce teachers to adopt imposed practices and sets of values offends liberal sensitivities. While

we may reject the overt regulative aims of the curriculum implementation and standards discourses, I would argue that we must also recognise the regulative role played by "assessment to support learning" as championed within the psychological discourse.

Table 2: Summary of mainstream assessment discourses

	Psychological	**Curriculum Implementation**	**Curriculum Standards**
focus	individual learner	system-wide curriculum	system-wide outcomes
aims	to produce valid knowledge about individual students	to effect reform	to produce higher achievement
assessment should be	'authentic' in the sense that it identifies real mathematical understanding	'authentic' in the sense that it matches the values of the desired curriculum	normative and challenging
individual students will benefit because	teaching will be matched to learning needs	teaching methods will match curriculum aims	the national economy will improve, leading to better individual opportunities
teacher's role	to know students and support their learning	to (be coerced to) implement changes in curriculum and teaching methods	to (be coerced to) adopt strategies that will lead to higher outcomes
student's role	learner	receiver of curriculum	future worker

THE REGULATIVE FUNCTIONS OF ASSESSMENT

We are all familiar with the explicitly regulative functions of assessment in the selection of students. We know that mathematics qualifications serve in many societies around the world as a means of discriminating between individuals when allocating educational and occupational opportunities, even where knowledge of mathematics itself may be irrelevant to the future performance of the individual. As Noss claimed in his critique of the UK National Curriculum, the purpose of assessing ability to perform long division is to "divide and rule" (Noss, 1990). But surely, you say, this is the function of those bad, summative forms of assessment arising within the discourse of standards. Surely we need to engage in some form of assessment in order to match our teaching to the needs of our

students? It is easy to assume that 'assessment to support learning' can only have beneficial effects. I will outline two challenges to this assumption. Firstly, does assessment really identify students' 'needs'? Secondly, what are the consequences of attempting to address these needs?

A challenge to the assumption that assessment is about discovering truth

Although teaching is no longer seen as simple transmission of knowledge and there is a general recognition among mathematics educators that students interpret what teachers say in multiple ways, this insight into the contingent nature of meaning making is not usually extended to how teachers interpret what students say or write. Mainstream thinking about assessment is still based on a naive transmission view of the nature of communication in which meaning resides within the text, independent of the reader, carrying the author's intentions exactly. The teacher/assessor's role is thus to 'extract the meaning' from the text produced by the student. Obvious failures to communicate – where different modes of communication (for example, a written test and a teacher observation of a child working) provide different messages about the 'same' student competence or where the teacher/assessor is unable to make sense of a written or spoken text produced by a student – are usually seen to be a 'language problem' for the student. But on what basis do we assume that, when teachers and other assessors do succeed in making sense of a student's text, they then know what the student intended to communicate? A more consistent epistemology would suggest that there is no necessary simple correspondence between a piece of text and the meanings its various readers construct. Rather, the meanings constructed will depend on the resources brought to bear on the text by individual readers. These resources will vary according to the discourse within which the text is read and the positions adopted by a particular reader within that discourse as well as the reader's previous experience (Kress, 1989). There can never be a guarantee that the interpretations made by the assessor are exactly those intended by the student. Indeed, studies of teacher/assessors demonstrate how different assessors can construct entirely different interpretations from the same text (Morgan, 1996; Watson & Morgan, 2000).

Moreover, even if teacher/assessors do succeed in reaching an interpretation of a student's text that is close to the meanings intended by the student, how can we assume that they then have a valid basis for making inferences about the nature of the student's mathematical understanding? Unless the student has a complete grasp of the ground rules (Edwards & Mercer, 1987) of the classroom and the assessment genre[4], they may not

attempt to communicate the particular aspects of their mathematical understanding that are anticipated by the teacher/assessor. This mismatch has been demonstrated in cases where mathematics assessment tasks are presented in 'context' (see, for example, Cooper, 1998). Kearns' (1998) interviews with students working on such tasks revealed that some students made deliberate and conscious choices between using mathematical knowledge or everyday knowledge for their solutions – choices that in some cases did not coincide with those their mathematics teachers would expect. Making the 'wrong' choice in these circumstances would be likely to lead to an assessment that the student's mathematical understanding was faulty, even though the student may have considered and deliberately decided to reject a solution that would have demonstrated 'correct' understanding.

Assessment practices that justify themselves in terms of a psychological discourse, therefore, discriminate between students not solely on the basis of their mathematical understanding but also on the basis of the extent to which they share the more general resources and expectations of their teachers, schools and assessment regimes. This results in disadvantage for students from non-dominant social groups – and the disadvantage is likely to be greatest where the ground rules for formulating acceptable responses are least explicit.

> Class bias is strongest in those tests which throw the examiner onto the implicit diffuse criteria of the traditional art of grading, such as the dissertation or the oral, an occasion for passing total judgements, armed with the unconscious criteria of social perception on total persons, whose moral and intellectual qualities are grasped through the infinitesimals of style or manners, accent or elocution, posture or mimicry, even clothing and cosmetics. (Bourdieu & Passeron, 1990, p. 162)

The challenge for the student, then, is not to acquire knowledge and understanding of mathematics but to acquire knowledge of the characteristics of the forms of behaviour that will allow her to be seen to know and understand, together with the skills necessary to display the appropriate behaviour. In Bernstein's terms, she needs to acquire the recognition rules that "regulate what meanings are relevant" and the realisation rules that "regulate how the meanings are to be put together to create the legitimate text" (Bernstein, 1996, p. 32). The ideals of 'reform' mathematics curricula, unfortunately, increase this challenge for the student. By weakening the framing of the pedagogic discourse - valuing creativity rather than industry, student empowerment rather than rule following - the criteria by which students are to be evaluated become increasingly implicit and invisible.

This does not mean that assessment criteria are any less determinate, merely that it more difficult to determine what they are.

Lerman and Tsatsaroni (1998) have argued that, just as traditional (strongly framed) forms of pedagogic discourse are inaccessible to working class students, these same students may be further disadvantaged by the discourse of 'reform' curricula and evaluation practices. Cooper and Dunne (Cooper, 1998; Cooper & Dunne, 1998) show that working class children, already achieving at a lower level overall, were even less successful on 'realistic' questions. They argue that, whereas the rules for answering traditional 'esoteric' mathematics questions are clear-cut, in order to answer such contextualised questions successfully, students have to judge very finely exactly how much everyday 'realistic' knowledge to use. The relatively poor performance of working class children on such contextualised tasks appears to be related to their use of inappropriate 'everyday' modes of response when they would need to draw on more formal mathematical methods in order to achieve the answers expected by the test setters. The implicit evaluation 'rules' applied within 'reform' curricula, valuing 'authentic' means of assessment, are likely to be most accessible to those groups of students whose cultural and linguistic background is closest to that of the school.

What are the consequences of addressing perceived needs?

I do not intend to go in detail into the obviously regulative uses made of summative assessment results at points of transition in students' educational careers. Rather, I shall consider briefly the consequences of assessments that teachers make in their day-to-day interactions with students. As Watson (1999) has argued, the judgements a teacher makes about an individual student affect the ways the teacher interacts with that student in the future. In particular, this will affect the tasks provided for the student and hence their opportunities for learning. If assessments are partial, inaccurate or biased (as I have argued they must be) there are obvious implications for (in)equity of opportunity (see Watson & Morgan, 2000).

But let us suppose for a moment that assessment is successful in identifying different levels or different kinds of understanding. As I showed earlier, according to mainstream psychological discourses, individual students will benefit from this assessment because it will facilitate teaching that will be matched to their learning needs. Differentiation of the mathematics curriculum on the basis of perceived differences between the 'needs' of individual pupils or groups of pupils is portrayed as desirable in current curriculum

documents. This is consistent with constructivist views which stress the individual nature of knowledge and learning. It is important to consider, however, the nature of the differentiated curriculum offered to different groups of students and the longer term consequences of such differentiation. For example, the latest version of the Mathematics National Curriculum for England and Wales (DfEE, 1999), due to start in September 2000, provides two different curricula for students in the final two years of compulsory schooling (15-16 year-olds), describing the 'Foundation' level curriculum as being intended to meet the needs of 'disaffected' students because of its focus on 'everyday' applications of mathematics that the students have already met in earlier years. There are a number of interesting issues that arise from this: the conflation of low attainment with disaffection; the idea that 'everyday' mathematics is more motivating and/or easier; the assumption that this group of students needs to continue to work on material they have already met rather than moving on to more advanced mathematics.

Given what has already been said about the differential outcomes of assessment processes for students from different social groups it seems that working-class students and those from other non-dominant groups are likely to be over-represented among those directed into the 'foundation' curriculum. Dowling's (Dowling, 1991) analysis of differentiated texts suggests that the 'everyday' mathematics provided those students assessed to be lower achievers constructs these students as engaged in manual rather than intellectual labour, hence reproducing existing class distinctions through the curriculum. Cooper (Cooper, 1994) provides a useful historical overview of differentiation, highlighting the issues for equity involved in providing a curriculum intended to meet the 'needs' of those identified as low achievers, and indicating the way in which constructing differences between groups of students serves the purpose of preparing students to take up different positions within society.

Regulation of teachers – tensions between discourses

It is not only students who are regulated by assessment. As I have already indicated, the curriculum discourses of implementation and standards focus on regulation at the level of the education system itself. Teachers are placed in an intermediary position as agents of the system. Official pronouncements on assessment addressed to teachers by governments, trainers and advisers assume that focusing on individual students and their learning needs is completely compatible with a simultaneous focus on system-wide

standards (see, for example, TGAT, 1987). Teachers have to operate in curriculum and assessment frameworks that make use of both psychological and curriculum discourses.

During my research into the discourse of mathematical investigation in schools in the UK (Morgan, 1995; 1998), I interviewed teachers as they engaged in the task of assessing students' reports of their investigative work. It emerged that they were often predominantly positioned within a psychological discourse. Thus they aimed towards the idea that the assessment ought to seek for a true representation of the student's mathematical understanding and used the evidence of this understanding in a student's text in order to suggest ways of supporting that student's future learning. However, they also exhibited tensions within this discourse and occasionally shifted out of it – painting an altogether different picture of the assessment process and of their positions within it. This occurred especially when the text they were assessing appeared unusual to them – a situation in which they were unable to rely on set routines and were therefore apparently prompted to reflect on and justify their judgements, often referring to past experience or common practices. For example, Dan highlighted the difference between what students know and can do and the requirements of the examination system.

> I had to pin people down and say I really can't give you the marks you deserve on this [....] they knew exactly what they were doing but they had to go back and rework that piece of work. (Dan)

Here the purpose of the assessment is not simply to measure what the student knows or can do. Dan appears to be working with two forms of measure: what the student deserves (presumably some absolute measure of his or her knowledge or capability) and the marks that can be allocated for the particular piece of work – the concrete text produced. The two measures cannot coincide until the student presents work in the form required by the examination. This focus on the concrete outcome is a feature of the discourse of standards. Dan's claimed inability to give the student "the marks you deserve" sets up a conflict between his own apparently preferred values (those of a psychological discourse, focusing on the characteristics of the individual student) and the values of the official examination system within which he is working (focusing on normative standards). At the same time he positions himself as powerless within the system.

It is not only students whose behaviour must conform to the expectations of an external authority; teachers also must abide by and impose the rules, even when these do not coincide with their own values and beliefs about the curriculum:

> We're actually marking by the criteria laid down by the exam board and so we rank them [the students] according to their [the exam board's] criteria perhaps rather than according to the criteria that we might use here. (Andy)

Andy's use of *we* here suggests that he is locating his own preferred criteria within a more widely accepted curriculum reform/implementation agenda. (It may also suggest that he assumes his interlocutor shares this agenda.) But he is unable to implement his preferred curriculum values because they do not coincide with those embodied in the official assessment system.

These teachers were working in a context in which their assessment activity was explicitly regulated by an external agency. Their assessment of their own students was subject to moderation and possible alteration by external assessors with high-stakes consequences both for their students (in terms of future educational and occupational opportunities) and for themselves (in terms of possible loss of face and professional standing). It is thus not surprising that a discourse of regulation emerged as they engaged in the assessment process: a discourse marked by the modality of compulsion seen in Dan's description of his own and his students' actions and by Andy's subordination of his own preferred criteria to those laid down by the examination board.

The explicit face of assessment as regulation emerges here where the assumptions of the psychological discourse and the curriculum implementation discourse break down as they come into tension with the standards discourse. Assessment cannot be about discovering and measuring the attributes of students if what the teacher knows to be the true state of a student's capability cannot be acknowledged because it is expressed in the wrong form. Assessment cannot reflect the values of the curriculum if there is a mismatch between the criteria arising from shared curriculum values and those imposed by an external authority.

CONCLUSIONS

Attempts to reform curriculum and assessment in accordance with constructivist or liberal/progressive principles seem doomed to come into conflict with the needs of the system to regulate the supply of future workers. Assessment is a major tool in this regulative process whether it is explicit, as in the case of traditional examination systems and the discourse of standards, or whether it is implicit, effected through the differential reading of texts produced by students with different degrees of cultural capital and through the differentiated curriculum provided to meet the 'needs' of these students. As well as acting to differentiate between students, assessment plays a major role in regulating

the curriculum and the extent to which teachers can act autonomously (though here too the regulation may be implicit or explicit).

Many of us here are teachers and are involved with curriculum development and teacher education as well as research. When we are positioned as teachers, as curriculum developers, as teacher educators, there is a tendency to engage with attempts to find 'better' ways of assessing. I certainly see this tendency in myself as I work with student teachers who find themselves in schools, expected to assess their students and required to fulfil the government prescribed standards in relation to assessment that I have quoted from earlier. (Indeed, I am required to assess how well they assess their students and to devise 'good' means of doing so.) When we position ourselves as researchers at a conference about Mathematics Education and Society, however, I would suggest that the search for better assessment is not an appropriate aim. Rather, we must aim to understand how assessment works in mathematics classrooms and more broadly in education systems, and to understand what its consequences are for individuals and for groups within society.

The mainstream discourses of assessment that I have identified serve to naturalise the regulative functions of assessment acts. Within these discourses it makes good sense to see assessment as essentially benign, bringing benefits to all students both as individual learners and as citizens of a prosperous society. I have argued that this 'good sense' can and should be challenged.

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[1] The 'traditional' and 'authentic' types of assessment instrument are strongly allied with the Type 1 (traditional) and Type 2 (liberal/progressive) pedagogic practices classified by Lerman and Tsatsaroni (1998).

[2] The source of these examples is a cartoon in *Mathematics Teaching* 116 (1986, p. 29) based on letters from Richard Noss and David Pimm.

[3] A more cynical reader might suggest that the intention was to harness and hence control and modify the teacher-led innovations.

[4] And I would agree with Cooper & Dunne (1998) when they suggest that specifying all the rules is an impossible task.

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